COMPONENT ARRANGEMENT FOR CARRYING CURRENT FOR CERAMIC HIGH-TEMPERATURE FUEL CELLS

Field of the invention

High-temperature fuel cells for converting chemical energy into electrical energy. The electrochemical conversion of energy and the apparatuses required to achieve this are becoming increasingly important on account of their good efficiency compared to other forms of conversion.

The invention relates to the further development of the electrochemical high-temperature cells using ceramic solid electrolytes as ion conductor, wherein the cells are to be substantially independent of the fuel used and are to ensure a space-saving arrangement.

In the narrow sense, the invention relates to a component arrangement for carrying current between adjacent flat, planar, stacked high-temperature fuel cells with solid electrolyte based on doped, stabilized zirconium oxide, the oxygen electrode of one fuel cell in each case being electrically connected to the fuel electrode of the following fuel cell, and the space which lies between the electrodes being divided by a gastight, electrically conducting separation plate into two spaces, which carry the different gaseous media fuel (CH_4) and oxygen carrier (O_2).

Background of the invention

High-temperature fuel cells with ceramic solid electrolytes are known from numerous publications. The actual elements for cells of this type may have a very wide range of shapes and dimensions. To minimize the ohmic voltage losses, it is attempted at all points to minimize the thickness of the electrolyte layer. The

shape and dimensions of the elements also depend on the requirement that it be possible for a multiplicity of cells be electrically connected in series, in order to achieve the required terminal voltage and to keep the current at a relatively low level.

In the case of a stacked arrangement of a multiplicity of plate-like planar fuel cells similar to the filter press principle, the current has to be passed perpendicular to the plane of the plate of the oxygen electrode of one cell to the fuel electrode of the following cell. Electrical connection elements for connection to the electrodes (current collectors) and separator plates (bipolar plates) are essential components required for this function.

The components which have been disclosed hitherto and their arrangements in many cases do not meet modern requirements with regard to the materials used, the design and fabrication and the long-term performance.

The known base elements used for fuel cells generally have a relatively complicated geometry, making it more difficult to construct compact, space-saving installations. In particular, there is no arrangement which is advantageous for optimum series connection of the individual cells and can be realized using simple fabrication means. In this context, in particular questions of contact-connection and current transfer have been only inadequately resolved.

Therefore, there is a considerable need for further development, simplification and rationalization of the construction and production of current-carrying base components and their optimum arrangement with respect to one another based on ceramic high-temperature fuel cells.

The following documents are cited in connection with

the prior art:

- O. Antonsen, W. Baukal and W. Fischer, "Hochtemperatur-Brennstoffbatterie mit keramischem Elektrolyten" [High-temperature fuel battery with ceramic electrolyte], Brown Boveri Mitteilungen January/February 1966, pages 21-30,
- US-A-4 692 274
- US-A-4 395 468
- W.J. Dollard and W.G. Parker, "An overview of the Westinghouse Electric Corporation solid oxide fuel cell program", Extended Abstracts, Fuel Cell Technology and Applications, International Seminar, The Hague, The Netherlands, 26 to 29 October 1987,
- F.J. Rohr, High-Temperature Fuel Cells, Solid Electrolytes, 1978 by Academic Press, Inc., pages 431 ff.
- D.C. Fee et al., Monolithic Fuel Cell Development, Argonne National Laboratory, Paper presented at the 1986 Fuel Cell Seminar, Oct. 26-29, 1986 Tucson, AZ, U.S. Department of Energy, The University of Chicago.

Summary of the invention

The invention is based on the object of providing a component arrangement for carrying current between adjacent, planar, stacked high-temperature fuel cells which on the hand ensures good electrical contact both with the electrodes of the fuel cell and between the other devices at temperatures of up to 1000°C, the intention being to ensure a high electrical conductivity and a low contact resistance. Moreover, the entire arrangement should have a sufficient long-term stability. The components are to be producible at low cost, reproducibly and exchangeably, and attention should be paid in particular to allowing rapid and simple dismantling.

This object is achieved by virtue of the fact that the

component arrangement mentioned in the introduction is realized in such a form that a planar smooth separator plate and current collectors, which are arranged on both sides of the separator plate and are fixedly anchored both in the oxygen electrode and in the fuel electrode are present, at least the current collector on one side being designed such that it can slide on the separator plate so as to move freely in the lateral direction parallel to the plane of the plate.

Way of carrying out the invention

The invention is described on the basis of the exemplary embodiments which are explained in more detail by figures, in which:

Fig.1 shows a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collectors which can move freely in the lateral direction on both sides of it in the form of corrugated strips,

Fig. 2 shows a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collectors which can move freely in the lateral direction on both sides of it comprising elements in strip or wire form,

Fig. 3 shows a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collector in wire form anchored securely on the oxygen side both in the separator plate and in the oxygen electrode,

Fig. 4 shows a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collector in the form of a multiply corrugated strip anchored securely on the oxygen side both in the separator plate and in the oxygen electrode.

Fig. 1 illustrates a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collectors in the form of corrugated strips which can move freely in the lateral direction on both sides of it. The actual high-temperature fuel cell comprises the ceramic solid electrolyte 1 made from doped, stabilized ZrO_2 and the porous (positive) oxygen electrode 2 (La/Mn perovskite) and the porous (negative) fuel electrode 3 (Ni/ZrO_2 cermet). 4 denotes a nickel fabric (wire mesh, felt, nonwoven, metal wool, etc.) which has been sintered, welded or soldered onto the fuel electrode 3. 5 denotes the current collector on the fuel side in the form of a strip which is corrugated in a trapezium shape and preferably consists of Ni. 6 denotes a punctiform soldered/welded join between the fuel-side current collector 5 and the nickel fabric 4. 7 denotes a gastight, electrically conducting separate plate made from an oxidation-resistant high-temperature alloy. Nickel, cobalt or iron alloys are fundamentally suitable for this component. In the present case, on the fuel side the separator plate 7 carries a nickel plating 8 as contact-imparting surface layer for sliding contact with the fuel-side current collector 5. The free lateral mobility parallel to the plane of the plate which is effected by this sliding contact is indicated by a double arrow. 9 denotes a thin precious metal plating on the oxygen side of the separator plate 7. This plating generally consists of Au, a Pt metal or a corresponding alloy. 10 denotes the current collector on the oxygen side in the form of a rectangularly corrugated strip, which generally consists of a thermally stable nickel or iron alloy. On the contact surface with the separator plate 7, the current collector carries a precious metal coating 11 consisting of a Pt metal. The lateral free mobility parallel to the plane of the plate is in each case indicated by a double arrow. The current collector 10

on the oxygen side is securely embedded in an electrically conducting manner in the oxygen electrode 2. The symbol CH_4 stands in general terms for the fuel cell space through which the gaseous fuel passes, and the symbol O_2 for the fuel cell space through which the gaseous oxygen carrier (air) passes.

Fig. 2 illustrates a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collectors comprising components in strip or wire form which can move freely in the lateral direction on both sides of it. Reference numerals 1 to 11 fundamentally correspond to those shown in Fig. 1. The current collector 10 on the oxygen side is in this case in the form of a trapezoidally corrugated strip. The apexes of the corrugation facing the separator plate, which carry the precious metal coating 11 on their contact surfaces are designed to be wider than the opposite apexes embedded in the oxygen electrode 2. The current collector 5 on the fuel side is in this case designed in the form of a relatively loose coil, the windings of which are slightly inclined with respect to the longitudinal axis. The lateral free mobility of the current collectors 5 and 10 parallel to the plane of the plate is once again indicated by a double arrow in each case.

Fig. 3 shows a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collector in wire form which is securely anchored both in the separator plate and in the oxygen electrode on the oxygen side. Reference numerals 1 to 8 correspond precisely to those used in Fig. 1. In this embodiment, the precious metal plating 9 on the oxygen side of the separator plate 7 is not present. The precious metal coating 11 of the contact surface of the oxygen-side current collector 10 is also absent. Instead, the latter is securely mechanically anchored, in a positively locking and electrically conducting

way, on the separator plate 7 by way of spot soldered or welded joins 12. The current collector 10 is in this case in the form of a thin-wire coil with windings which are significantly inclined with respect to the longitudinal axis of the helix line and are flattened, which coil is completely clamped in place both on the side of the separator plate 7 (spot joins 12) and on the side of the oxygen electrode 2 (embedding). The wire diameter of the current collector 10 is greatly exaggerated in the illustration presented in the figure. The current collector 5 on the fuel side is in this case designed in the form of a thin, sinusoidally corrugated strip. Its lateral mobility parallel to the plane of the plate is indicated by a double arrow.

Fig. 4 illustrates a diagrammatic section/front view through a fuel cell arrangement with separator plate and current collectors in the form of a multiply corrugated strip securely anchored both in the separator plate and in the oxygen electrode on the oxygen side. The reference numerals fundamentally correspond to those used in Fig. 3. The current collector 5 on the fuel side is in this case designed in the form of a loose metal wall or a knitted metal fabric and is securely combined with the nickel fabric 4 via spot soldered joins to form a single entity. The lateral mobility of individual corrugation-like parts of the current collector 5 is indicated by a double arrow. The current collector 10 on the oxygen side is designed in the form of a double-corrugated thin strip.

In the region of the zero cross, an auxiliary corrugation of smaller amplitude and smaller wavelength is superimposed on a sinusoidal, inclined main corrugation. The result is a structure which, while being rigid perpendicular to the plane of the plate, has a high elasticity parallel to this plane, so that the forces acting on the clamping points (oxygen electrode 2 and separator plate 7) are kept at a low

level. By virtue of being completely clamped on both sides, the current collector 10 does not in any case need to transmit any contact pressure force; it serves only for electrical current transmission. It can therefore be made from less thermally stable material.

Exemplary embodiment 1:

cf. Fig. 1!

A component arrangement for carrying current was constructed from the following individual parts:
Nickel fabric on the fuel electrode current collector, fuel side separator plate current collector, oxygen side.

The actual fuel cell comprised a flat, planar plate with the centrally arranged solid electrolyte (1) made from stabilized ZrO_2, a sintered-on oxygen electrode 2 made from La/Mn perovskite and a likewise sintered-on fuel electrode 3 made from a Ni/ZrO_2 cermet. A nickel fabric 4 (wire diameter 0.03 mm; mesh width 0.25 mm) was soldered onto the fuel electrode over a large area with the aid of a sintering additive which lowers the melting point.

The fuel-side current collector 5 comprised a trapezoidally corrugated strip of nickel having the following dimensions:
Thickness = 0.15 mm
Width = 1.8 mm
Wavelength = 2 mm
Amplitude = 0.75 mm

At the apexes on one side, the current collector 5 was combined, via spot soldered joins 6, with the nickel fabric 4 to form an integral unit. A nickel solder with small additions of Ag, Cr and Si, the melting point of which was approx. 100°C below that of pure nickel, was

used for this purpose.

The gastight, electrically conducting separator plate 7 comprised a 0.35 mm thick uncoated metal sheet of an oxidation-resistant iron-based alloy having the materials number 1.4762 in accordance with German Standard DIN named X10CrAl124 and having the following composition:

Cr = 24% by weight

Al = 1.5% by weight

Si = 0.9% by weight

Mn = 0.8% by weight

C = 0.10% by weight

Fe = Remainder

This carrier material for the separator plate 7 was electrochemically provided with a 30 μm thick nickel plating 8 on the fuel side. In the same way, a precious metal plating 9 in the form of a 5 μm thick Au layer was applied by electroplating to the oxygen side.

The oxygen-side current collector 10 comprised a rectangularly corrugated strip which additionally has a fine corrugation on the vertical parts (webs). The dimensions of the main corrugation were as follows:

Thickness = 0.10 mm

Width = 2 mm

Wavelength = 3.5 mm

Amplitude = 1.4 mm

The material selected was an oxide dispersion hardened nickel-base superalloy, trade name MA 754, produced by Inco, having the following composition:

Cr = 20.0% by weight

Al = 0.3% by weight

Ti = 0.5% by weight

C = 0.08% by weight

Y_2O_3 = 0.6% by weight

Ni = Remainder

The current collector 10 was provided, on the flat apexes, facing the separator plate 7, of the rectangular corrugation, with a precious metal coating 11 in the form of Pt applied in a thickness of 3 μm. This layer was applied electrochemically after a prior 0.5 μm thick gold plating. The precious metal coating 11 ensures perfect current transmission at the contact surface between the current collector and the separator plate in operation. The roughened flat apexes of the current collector 10 facing the oxygen electrode 2 were embedded or sintered onto the La/Mn perovskite of the electrode, using suitable sintering additives and a reducing to neutral sintering atmosphere.

After completed assembly and mechanical and thermal stressing, it was possible to ascertain that the current collectors 5 and 10 had a slight resilience in the direction perpendicular to the plane of the plate but were generally comparatively rigid, whereas in the lateral direction they were able to move by sliding freely on the separator plate 7 parallel to the plane of the plate.

Exemplary embodiment 2:

cf. Fig. 2!

The structure of the component arrangement for carrying current was fundamentally the same as in Example 1.

This time, the nickel fabric 4 comprised more or less felted, very thin wires and, as in Example 1, was sintered onto the fuel electrode 3 over a large area. The fuel-side current collector 5 comprised a relatively loose coil of nickel wire, the windings of which were slightly inclined with respect to the longitudinal axis. The dimensions were as follows:
Wire diameter = 0.30 mm

Winding diameter = 1.5 mm

Pitch = 1 mm

Inclination of the winding with respect to normal plane approx. 15°

The current collector, at the associated apexes of the windings, was combined with the nickel fabric (felt) via spot soldered joins 6 to form a single unit.

The gastight separator plate 7 comprised a 0.4 mm thick metal sheet made from oxide dispersion hardened iron-based alloy, trade name MA 956, produced by Inco, having the following composition:

Cr = 20.0% by weight

Al = 4.5% by weight

Ti = 0.5% by weight

Y_2O_3 = 0.5% by weight

Fe = Remainder

The carrier material of this separator plate 7 was electrochemically provided with a 40 μm thick nickel plating 8 on the fuel side. A precious metal plating 9 in the form of an Au Pd alloy containing 20% by weight Pd was applied electrochemically to the oxygen side by a plurality of Au and Pd layers being deposited in succession and the assembly then being subjected to diffusion annealing in vacuo at 900°C for 12 h. The finished precious metal plating has a layer thickness of 6 μm. The advantage of this Au/Pd alloy lies in the melting point (solidus temperature), which is approx. 300°C higher than that of pure Au.

The oxygen-side current collector 10 comprised a trapezoidally corrugated strip with the following dimensions:

Thickness = 0.15 mm

Width = 2.4 mm

Wavelength = 3 mm

Amplitude = 1.5 mm

The material used was a modified oxide dispersion hardened nickel-based superalloy having the following composition:

Cr = 17.0% by weight
Al = 1.5% by weight
Mo = 2.0% by weight
W = 3.5% by weight
Ta = 2.0% by weight
Zr = 0.15% by weight
B = 0.01% by weight
C = 0.05% by weight
Y_2O_3 = % by weight
Ni = Remainder

The current collector 10 was provided, at the flat apexes, facing the separator plate 7, of the trapezoidal corrugation, with a precious metal coating 11 in the form of Pt/Pd applied in a thickness of 5 μm. The Pt/Pd alloy contains 50% by weight Pt and 50% by weight Pd and was deposited electrochemically after a previous 0.5 μm thick gold plating. The narrow flat apexes, facing the oxygen electrode 2, of the current collector 10 were embedded in the La/Mn perovskite of the electrode and securely anchored by sintering.

The current collector 10 was relatively rigid in the direction perpendicular to the plane of the plate, whereas the current collector 5 under load, yielded to a relatively considerable extent. Both current collectors were able to move by sliding freely in the lateral direction on the separator plate 7 parallel to the plane of the plate.

Exemplary embodiment 3:

cf. Fig. 3!

The structure of the component arrangement was similar

to that of Example 1, except that the current collector 10 on the oxygen side was anchored both in the oxygen electrode 2 and on the separator plate 7. The nickel fabric 4 comprised a braided wire fabric of similar structure and similar dimensions to in Example 1. It was sintered onto the fuel electrode 3 over a large area.

The fuel-side current collector 5 comprised a sinusoidally corrugated strip of a nickel-base superalloy, trade name Inconel 600, having the following composition:
Cr = 15.5% by weight
Fe = 8.0% by weight
Min = 0.5% by weight
Si = 0.2% by weight
C = 0.08% by weight
Ni = Remainder

The dimensions of the corrugation were as follows:
Thickness = 0.08 mm
Width = 2.5 mm
Wavelength = 1.5 mm
Amplitude = 0.7 mm

The current collector 5 was joined to the nickel fabric 4 at the apexes on one side via spot soldered joins 6.

The separator plate 7 comprised a 0.3 mm thick uncoated metal sheet of an oxidation-resistant nickel base superalloy, trade name Nimonic 75, having the following composition:
Cr = 19.5% by weight
Ti = 0.4% by weight
Fe = 3.0% by weight
Mn = 0.3% by weight
Si = 0.3% by weight
C = 0.10% by weight
Ni = Remainder

The carrier material of the separator plate 7 was electrochemically provided with a 35 μm thick nickel plating 8 on the fuel side. The oxygen side remained unchanged, i.e. without any plating. On the other hand, it was cleaned, pickled and polished to a high polish before further processing.

The oxygen-side current collector 10 comprised a thin-wire coil with flattened windings positioned very obliquely with respect to the longitudinal axis of the helix line. The dimensions were as follows:
Wire diameter = 0.18 mm
Winding diameter = 3 mm
Pitch = 0.8 mm
Oblique position of the winding with respect to normal plane approx. 45°

The material used was an oxidation-resistant iron base alloy, materials No. 1.4742 in accordance with German Standard DIN named X10CrAl18, having the following composition:
Cr = 18% by weight
Al = 1.0% by weight
Si = 0.9% by weight
Mn = 0.8% by weight
C = 0.10% by weight
Fe = Remainder

At the apexes of the windings facing the separator plate 7, the current collector 10 was securely anchored, in an electrically conducting and mechanically positively locking manner, to the separator plate 7 by spot welded joins 12. The apexes of the windings facing the oxygen electrode 2 were embedded in the La/Mn perovskite of the electrode and secured by sintering.

On account of the oblique positioning of the windings

of the coil, the current collector 10, despite being clamped on both sides, was significantly elastic both in the direction perpendicular to the plane of the plate and also parallel thereto. Since a contact pressure is not required either on the oxygen electrode 2 or on the separator plate 7 for good transmission of current, the current collector 10 can have as low a spring constant as desired.

Exemplary embodiment 4:

cf. Fig. 4!

The structure of the component arrangement for carrying current was fundamentally the same as in Example 3. The nickel fabric 4 comprised a felt-like or metal-wool-like nonwoven and was sintered onto the fuel electrode 3 over a large area, as in Example 1 (diffusion welding).
The fuel-side current collector 5 comprised a type of metal wool (knitted metal fabric), produced from thin nickel wires braided in plaited fashion. The dimensions were as follows:
Wire diameter = 0.05 mm
Total height of the nonwoven = 1.8 mm

The current collector 5 was joined to the nickel fabric 4 at numerous contact points via spot soldered joins using a nickel solder with good wetting properties and a melting point of approx. 1300°C.

The separator plate 7 comprised a 0.35 mm thick unplated metal sheet of an oxide dispersion hardened nickel-base superalloy with a low Al and Ti content, trade name MA 754 produced by Inco, with the following composition:
Cr = 20.0% by weight
Al = 0.3% by weight
Ti = 0.5% by weight

C = 0.05% by weight
Y_2O_3 = 0.6% by weight
Ni = Remainder

The carrier material of the separator plate 7 was provided on the fuel side with a 25 μm thick nickel plating 8 by electroplating. The oxygen side remained unchanged.

The oxygen-side current collector 10 comprised a double-corrugated thin strip. In the region of the zero crossing, a secondary corrugation of smaller amplitude and smaller wavelength was superimposed on a sinusoidal, inclined main corrugation. The dimensions of the main corrugation were as follows.
Strip thickness = 0.12 mm
Strip width = 2.2 mm
Wavelength = 3 mm
Amplitude = 1.6 mm
Inclined position of the winding with respect to normal plane approx. 30°

The material used was an oxidation-resistant Fe/Cr/Al alloy, materials No. 1.4767 in accordance with German Standard DIN named CrAl20 5, having the following composition:
Cr = 20% by weight
Al = 5% by weight
Si = 0.6% by weight
Mn = 0.8% by weight
C = 0.08% by weight
Fe = Remainder

At the apexes of the main corrugation facing the separator plate 7, the current collector 10 was electrically conductively joined to the separator plate 7 by spot Ni/Cr soldered joins 12. The apexes of the main corrugation facing the oxygen electrode 2 were embedded in the La/Mn perovskite of the electrode and

securely anchored.
By virtue of the double-corrugation design, the current collector was very elastic in both main directions (perpendicular to the plane of the plate and parallel thereto). The statements made under Example 3 apply.

To increase the long-term stability of the individual components, in particular of the precious metal coatings (plate 9 on the oxygen side of the separator plate 7; coating 11 on the contact surface of the current collector 10 with the separator plate 7), it is advantageous, in all Examples 1 to 4, for a diffusion barrier layer based on a silicon-containing intermetallic compound to be provided between the base body (carrier metal) and the precious metal surface layer. Barrier layers of this type are generally applied to the carrier metal by flame spraying, plasma spraying, or exceptionally (because this is an expensive option!) by sputtering. It is preferable to use a nickel silicide for this purpose. These measures in particular greatly delay or even virtually eliminate the diffusion of the precious metal into the carrier metal below.

The invention is not restricted to the exemplary embodiments.

The component arrangement for carrying current between adjacent flat, planar, stacked high-temperature fuel cells with solid electrolyte 1 based on doped, stabilized zirconium oxide, the oxygen electrode 2 of one fuel cell in each case being electrically connected to the fuel electrode 3 of the following fuel cell, and the space which lies between the electrodes 2; 3 being divided by a gastight, electrically conducting separator plate 7 into two spaces, which carry the different gaseous media fuel CH_4 and oxygen carrier O_2, consists in general terms in the fact that a planar smooth separator plate 7 and current collectors 5; 10,

which are arranged on both sides of the separator plate and are fixedly anchored both in the oxygen electrode 2 and in the fuel electrode 3 are present, at least the current collector on one side being designed such that it can slide on the separator plate 7 so as to move freely in the lateral direction parallel to the plane of the plate. Preferably, the component arrangement comprising the separator plate 7 consists of a thermally stable high-temperature alloy which on the oxygen side is plated with a precious metal 9 or a precious metal alloy and on the fuel side is plated with nickel 8 or a high-percentage nickel alloy, wherein the current collector 10 on the oxygen side consists of an oxidation-resistant thermally stable alloy which, at least at the contact locations with the separator plate 7, is coated with a precious metal 11 and on its opposite side is securely embedded in the oxygen electrode 2, which consists of La/Mn perovskite, in that furthermore the current collector 5 on the fuel side consists of nickel or a high-percentage nickel alloy and is fixedly joined to the fuel electrode 3, which consists of a Ni/ZrO_2 cermet, by a soldered, welded or sintered join 6 via a nickel fabric 4.

In specific embodiment of the component arrangement, the current collector 10, on the oxygen side, is fixedly joined to the separator plate by a soldered, welded or sintered join 12 via the contact points coated with precious metal.

The component arrangement advantageously consists in the fact that on the oxygen side the current collector 10 consists of a carrier of an iron-base or nickel-base superalloy with or without dispersion hardening, and in that at least those locations between carrier metal and precious metal coating 9 which are coated with a precious metal selected from the group consisting of Au, Pd, Pt, Rh or an alloy of at least two of these elements have a diffusion barrier layer based on a

silicon-containing intermetallic compound. The current collectors 5; 10 are in the form of singly or multiply corrugated, bent or pleated strips or of wire coils, braided wire fabrics, woven metal fabrics or of metal felts or nonwovens.

Claims

1. Component arrangement for carrying current between adjacent flat, planar, stacked high-temperature fuel cells with solid electrolyte (1) based on doped, stabilized zirconium oxide, the oxygen electrode (2) of one fuel cell in each case being electrically connected to the fuel electrode (3) of the following fuel cell, and the space which lies between the electrodes (2; 3) being divided by a gastight, electrically conducting separation plate (7) into two spaces, which carry the different gaseous media fuel (CH_4) and oxygen carrier (O_2), characterized in that a planar smooth separator plate (7) and current collectors (5; 10), which are arranged on both sides of the separator plate and are fixedly anchored both in the oxygen electrode (2) and in the fuel electrode (3) are present, at least the current collector on one side being designed such that it can slide on the separator plate (7) so as to move freely in the lateral direction parallel to the plane of the plate.

2. Component arrangement according to Claim 1, characterized in that the separator plate (7) consists of a thermally stable high-temperature alloy which on the oxygen side is plated with a precious metal (9) or a precious metal alloy and on the fuel side is plated with nickel (8) or a high-percentage nickel alloy, and in that the current collector (10) on the oxygen side consists of an oxidation-resistant thermally stable alloy which, at least at the contact locations with the separator plate (7), is coated with a precious metal (11) and on its opposite side is securely embedded in the oxygen electrode (2), which consists of La/Mn perovskite, in that furthermore the current collector (5) on the fuel side consists of nickel or a high-percentage nickel alloy and is fixedly joined to the fuel electrode (3), which consists of a Ni/ZrO_2 cermet,

by a soldered, welded or sintered join (6) via a nickel fabric (4).

3. Component arrangement according to Claim 2, characterized in that the current collector (10), on the oxygen side, is fixedly joined to the separator plate by a soldered, welded or sintered join (12) via the contact points coated with precious metal.

4. Component arrangement according to Claim 2 or 3, characterized in that on the oxygen side the current collector (10) consists of a carrier of an iron-base or nickel-base superalloy with or without dispersion hardening, and in that at least those locations between carrier metal and precious metal coating (9) which are coated with a precious metal selected from the group consisting of Au, Pd, Pt, Rh or an alloy of at least two of these elements have a diffusion barrier layer based on a silicon-containing intermetallic compound.

5. Component arrangement according to one of the preceding claims, characterized in that the current collectors (5; 10) are in the form of singly or multiply corrugated, bent or pleated strips or of wire coils, braided wire fabrics, woven metal fabrics or of metal felts or nonwovens.

Fig.1

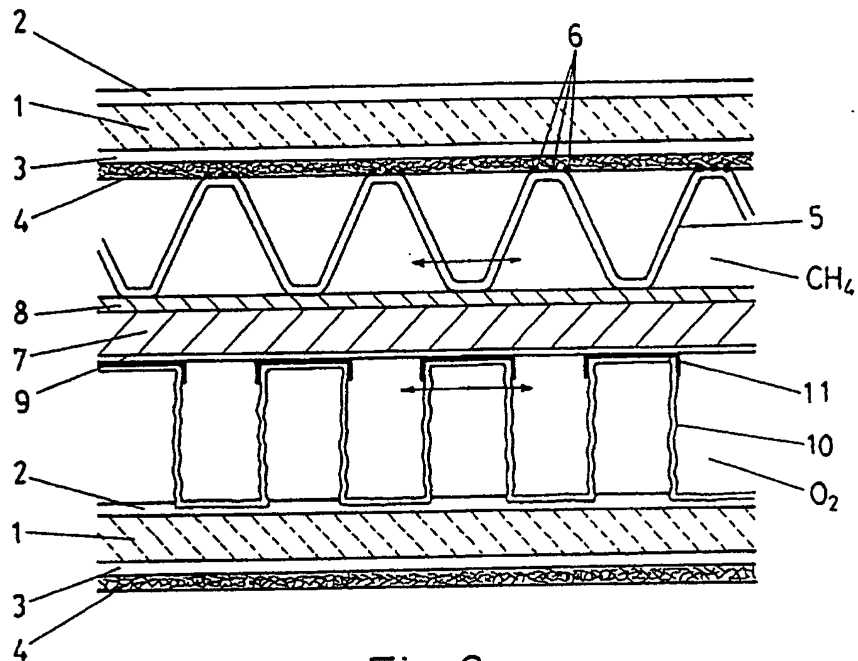

Fig.2

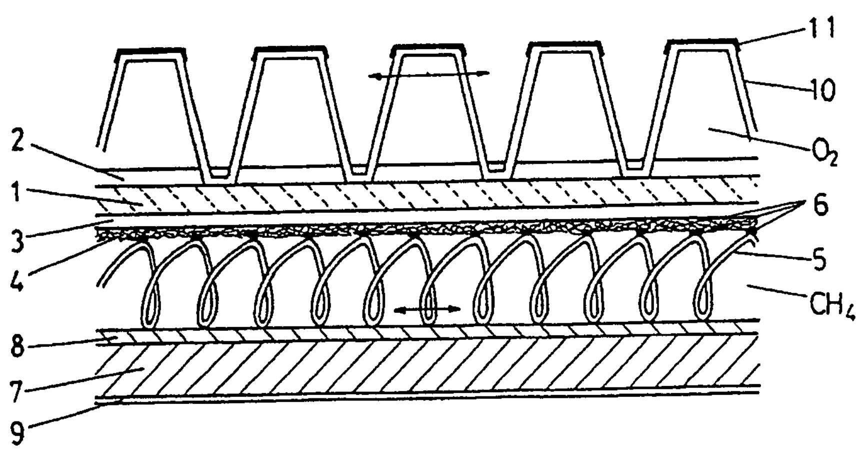

Fig.3

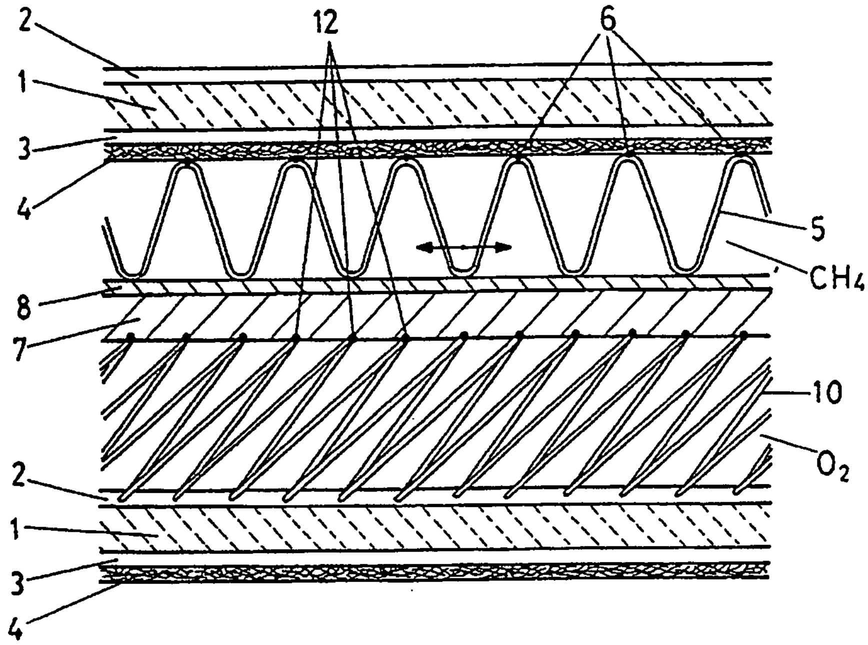

Fig.4